TRIPLE “T”: IN SEARCH OF INNOVATIVE DESIGN TEACHING METHODS

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Abstract
This study describes the results of a graduate class given in the Doctoral Program of the School of Civil Engineering, Architecture and Urban Design at the State University of Campinas, UNICAMP, Campinas, Brazil. In the second semester of 2005 a design methods course was given with an emphasis on design education. Thirty students participated. The course resulted in six innovative ways of transforming the “typical design studio” of traditional architecture courses in Brazil. The proposals were evaluated in relation to procedural advantages and disadvantages, learning competences, teaching levels and expectancies of instructors and students. Two teaching innovation examples are presented and discussed here.

Keywords: architectural design studio, creative design process, teaching methods

1 Introduction

Discussions on design education have produced insights and methods. Large bibliographies have been compiled (Smith, 2004) and new ways of teaching have been experimented with. Studio design teaching methods have been examined in relation to diverse aspects (learning experiences, efficiency, quality of design).

Schön (1987) and later Brawn (2003) describe design as a reflective conversation with the design situation, thus addressing the human thought-processes and the language (drawings, models) used to make decisions in the process. Other
studies identified problems in architectural education as related to design communication and the introduction and application of computer-aided design in architectural courses (Nicol & Pilling, 2000)

Viewing architecture as pure art has also been identified as a problem in architectural education. Investigations on typical professional practices have uncovered that architects lack knowledge on or fail to anticipate users’ needs (SALAMA, 1997). Importance given to the artistic content often causes architects to ignore social aspects in architecture and to emphasize their self-expression. The aesthetic or formal bias is further reinforced by most architectural publications, used as teaching material in most design disciplines (NASAR, 1986). Architectural criticism is virtually devoid of human content and directed towards the formal aspects of design. Even technical aspects, evaluation results and user satisfaction rates are rarely present in architectural journals used by students in design classes.

To discuss these problems in architectural education and propose new approaches to design studio activities, a graduate class was conducted in the Doctoral Program of the School of Civil Engineering, Architecture and Urban Design at the State University of Campinas, UNICAMP-Brazil. The graduate program includes a design methods discipline, which was offered in the second semester of 2005 with an emphasis on design education. Thirty graduate students participated in this course, which resulted in six innovative ways of transforming the “typical design studio” of traditional architecture courses in Brazil, two of which are discussed in depth here.

2 Graduate Course Description

The graduate course structure included formal lectures on design methods and the creative process in architecture. Invited talks exemplified some specific methods, such as the axiomatic design method (Suh, 2000) and Triz (Altshuller, 1946; Mann 2001 & Kiatake 2004). Conceptual research on creativity was discussed (Mumford et al., 1994; Torrance, 1962; Stemberg, 1988; Boden, 1991 & Hyman, 1998). Findings on design teaching in Brazil were presented (Sprechmann, 2003 & Pina et al., 2005). Graduate students were introduced to a varied bibliography on design and teaching methods in architecture and presented seminars on major authors in the field (Schön, 2001; Jones, 1980; Akin, 1986; Dülgerogly, 1999; Brawn 2003; Lawson; 1997). Visual research methods, as well as programming and evaluation techniques were introduced to students as means of improving design education (Sanoff, 1991 & Preiser and Vischer, 2005). Publications on teaching methods for university level education were also discussed (Masetto, 2003 & Kolb, 1984).

After the literature and conceptual model searches were completed six different teaching methods were discussed through a group dynamics process:

1. Traditional studio teaching based on a given architectural program and site for a specific design project.
2. Traditional studio teaching based on the discussion of an architectural program, elaborated by students and its appropriate urban setting.

3. Introduction of an actual, local design problem into the studio and the development of a participatory process, with problem analysis and solution justification by students.

4. Teaching design combining architectural theory with practical design activities.

5. Teaching design using “form generation” methods and formal architectural languages.

6. Teaching design using specific CAD design tools.

All six methods were evaluated with regard to their advantages and disadvantages, the necessary preparations and possible hurdles they may present in the teaching studio. The students’ learning curve was discussed as well as the detailed competency that students may gain from each method. Table 1 shows a abstract of the analysis of these methods.

Once students absorbed the research finding on design education, six groups were formed to develop proposals for innovative design education methods. The groups were asked to develop methods, which overcome some of the disadvantages exposed in existing methods and increase learning of important concepts in architectural design. The teams were free to choose any type of teaching method and testing with undergraduate students was not mandatory, since this was not possible for all groups and in the span of a few weeks.

3 Proposals of Innovative Teaching Methods

The groups of graduate students presented six new methods. Two methods are presented here: 1. Teaching design through the use of Frank Lloyd Wright’s architectural form grammar and 2. Teaching through the “anti model”.

The first method was tested with a group of students and the other example presented a day-by-day course structure, studio activities, explanations and justifications.

3.1 Frank Lloyd Wright’s architectural form grammar

In this method emphasis was given to Computer Aided Design as a creative tool. The teaching model was developed on the basis of a publication of the “Prairie Houses Language” by Koning and Eizenberg (1981) and the theory of shape grammars presented by Stiny e Gips (1972).

Shape grammars are known as powerful algorithms in design methods and have been used to generate alternatives and variations of specific architectural models, such as the Palladian villa grammar (Mitchell, 1996). Shape grammars are based on a set of geometric rules that describe a specific architectural style and can be
Table 1: Analysis of teaching design models

<table>
<thead>
<tr>
<th>Teaching model</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td><strong>Advan.:</strong></td>
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<tr>
<td>Standardization</td>
<td>Freedom to act</td>
<td>Getting to know real users</td>
<td>Learning of concepts and repertoire</td>
<td>Improve spatial perception and drawing skills</td>
<td>Improve spatial perception</td>
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<tr>
<td>All students develop same problem</td>
<td>Incentive to research and creativity</td>
<td>Social interest and urban insertion</td>
<td>Break the creative myth (&quot;tabula rasa&quot;)</td>
<td>Acquire structured design method</td>
<td>Learns new techniques</td>
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<tr>
<td>Application of previously acquired knowledge</td>
<td>Feeling of involvement with reality</td>
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<td><strong>Disadvan.:</strong></td>
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<tr>
<td>Restrict creative investigation</td>
<td>Needs background information</td>
<td>May create false expectancy of users</td>
<td>Short time span available</td>
<td>May cause addictions to specific methods</td>
<td>Addition to one method</td>
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<tr>
<td>Lack of importance of architectural program</td>
<td>Time consuming, Problem difficulties not predefined</td>
<td>Safety issues (unsafe urban areas)</td>
<td>Students lack research methodology background</td>
<td>Problems are treated in isolation</td>
<td>Belief in unique solutions</td>
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<td>Skipping of important steps, Trial and error</td>
<td>Time consuming</td>
<td>Students need maturity</td>
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<td>Without insertion of reality</td>
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<td><strong>Learn. competence.</strong></td>
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<td>Design decision making</td>
<td>Investigative</td>
<td>Judgments of values</td>
<td>Concepts</td>
<td>Analogies</td>
<td>Training in tools</td>
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<tr>
<td>Design communication</td>
<td>Creative</td>
<td>Learn to see through other peoples eyes</td>
<td>Repertoire</td>
<td>Structured creative process</td>
<td>Competency with CAD</td>
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<td>Capacity to judge decisions</td>
<td>Communication mediums</td>
<td>Discuss subjectivity</td>
<td>Spatial perception</td>
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<td><strong>Course Level</strong></td>
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<td>Initial level</td>
<td>Initial level</td>
<td>Intermediate level</td>
<td>All levels</td>
<td>Final year</td>
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<td><strong>Instructor expect.</strong></td>
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<td>Typical design instruction guidance</td>
<td>Need great responsibility and careful planning</td>
<td>Special planning necessary</td>
<td>Large experience and competency</td>
<td>Must have experience with design methods</td>
<td>Must dominate tools</td>
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<td><strong>Eval. &amp; testing</strong></td>
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<tr>
<td>Subjective - formal aspects</td>
<td>Subjective and complex</td>
<td>May use participants (client) in evaluation</td>
<td>Seminars, Written tests</td>
<td>Justified design projects</td>
<td>Teal knowledge on design methods</td>
<td>Judges use of tool as well as design quality</td>
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</table>
applied step by step to create new designs. These grammars can be developed in two or three dimensions. In our examples grammars were experimented conceptually through the physical manipulation of foam rubber building blocks and the theory of shape grammars was introduced to increase students theoretical background. Architectural theory was also applied through discussion and experimentation of the design principles of the Prairie Houses of Frank Lloyd Wright.

Shape Grammars were used to stimulate the generation of forms. To prepare students to apply computer tools to the creative design phase this teaching experiment used three-dimensional physical models (building blocks) as shown in Figure 1. Students can freely manipulate such blocks on the drawing board in the design studio and they can be easily translated into computational solids and thus may stimulate the use of CAD at an early stage of design development.

![Figure 1: Manipulation of functional building blocks in shape grammars](image)

The design studio experiment was divided into three phases as shown below. First architectural and shape grammar theory was introduced to students in the form of lectures, which exemplified 9 principal Prairie House design rules. The evolution of Frank Lloyd Wrights designs of the Prairie period, from 1898 to 1909 was discussed and analyzed in terms of the spatial distribution of functions. In the second phase students started manipulating, according to the 9 grammar rules, their functional building blocks and evaluated the resulting architectural volumes (Fig. 1). The blocks were pre-dimensioned and their functions were defined by different colors. A hypothetical location was given with definition of orientation. Adjustments were made to obtain design (viable forms) and functional logics according to the Prairie House principles. Finally students presented their designs and justified the results according to Prairie House principles and architectural design quality. The computational implementation of the experiment, in VBA (Visual Basic for Application), was then discussed with students to show the advantages of using rules and tools in design. The discussion also touched on the subject of creativity. The rich results of the students work demonstrated that the application of rigid rules does not interfere in the creative process but on the contrary enriches it. Finally students presented their designs and justified the results according to Prairie house principles and
architectural design quality. The computational implementation of the experiment, in VBA (Visual Basic for Application), was then discussed with students to show the advantages of using rules and tools in design. The discussion also touched on the subject of creativity. The rich results of the students' work demonstrated that the application of rigid rules does not interfere in the creative process but on the contrary enriches it.

The teaching experiment was highly evaluated by both students and teachers and will be applied to a creative design-computing course in the first semester of 2006.

3.2 Teaching through the “anti model”.

The goals in the second method, presented in this paper, were to demystify design as a “divine act”, thus an anti ego model of design teaching was proposed. In this method students are asked to develop their capacity to observe the built environment, criticize and propose solutions to a problem posed. Teachers should guide students to learn through their own errors, but should not use intimidating methods. Thus “positive thinking” should be practiced. The proposal should be applied at the beginning of an architecture course so students acquire a critical sense and a design method, which they can apply to other design courses. The structure of this proposal is shown in Fig. 2.

Fig. 2: Structure of the “Anti-Model” design teaching method

The proposed method is based on the literature on scientific methods brought forward by Popper and its application to architectural design (BRAWNE, 2003). The scientific method follows the phases of: the observation of a phenomenon,
abstraction and testing. Design on the other hand must follow a more complex structure of: data collection, information organization, critical problem evaluation, problem understanding, tentative design solutions and elimination of errors through analysis. To develop this teaching model differences between design projects at the professional and the teaching level were evaluated, as seen in Fig. 3. This analysis shows that the professional process generally is more direct, due participation of client, consultants and a design team with expertise specializations. At the teaching level collaborative design is rare and the student is mostly left to his own devices. On the other hand verbal communication is important in the teaching environment, through the typical studio “crits”, where instructors give verbal guidance to design ideas.

Fig. 3: Analysis of design projects at the professional and teaching levels
The “anti-model” proposal puts importance on student observations and critical error identification. Thus students should look for “anti-solutions” and at the beginning should define their problems in terms of wrong design decisions, as shown in Fig. 4. This analysis phase is seen as increasing student’s sense of criticism. Once prepared to identify design errors, the student will begin his own design solution search.

The design problem is then researched on various levels: conceptual, technical, formal and compositional as well as functional (Fig. 2). From this acquired knowledge and the “what not to do” experience students gain a critical sense of design procedure and should be able to embark on the next phase in design development: the search for design references. Then tentative design solutions are presented and students identify their own errors. The final stage of the teaching proposal includes a trial and error method in refining the design solution as shown in Fig. 2.

Fig. 4: Looking at “anti-examples”

2D mock-ups may be used at this stage to get a better feel of solutions. Possible errors may also become apparent, as shown in Fig. 5. These mock-ups also show students the importance of 2d drawings in the design process, however through its “three dimensionality” in reality.

Fig. 5: Learning through 2D mock-ups
The “anti-model” proposal was tested through an urban design exercise. The goal in this exercise was to increase students’ awareness of the impact of individual architectural proposals on a larger scale. Thus the sum of “good” designs is shown not always to be a “valid” whole. To study the city through its errors was reinforced through critical observations of Escher’s “anti-model” and creative solutions to common problems in design (climbing and descending) as shown in Fig. 6. The Escher “anti-model” increases awareness on the spatial properties of convex and concave architectural elements and the “climbing and descending” model emphasizes circulation as an important aspect in design.

Fig. 6: Learning from M. C. Escher

4 Concluding Remarks

As can be seen the innovative proposals for new ways of teaching design were varied, supported diverse activities and had specific goals in mind. The teaching experiment of Frank Lloyd Wright’s architectural form grammar was highly evaluated by both students and teachers and will be applied to a creative design-computing course in the University’s under-graduate course in the first semester of 2006. The “anti-model” was not yet fully tested in the undergraduate studio environment, but gained special interest in the discussions of the graduate course described here. The creative approach of using errors to stimulate critical thought was considered innovative and potentially productive for the typical design studio setting. Although most architectural education emphasizes the use of models and therefore the third dimension in design, this method showed that the two dimensional approach can be used positively. Also the method showed that this approach must be trained, since design is still based primarily on 2D communications.

The results of the graduate level course on design methods and design teaching were made available in the University’s distance education environment and are thus open to criticism and refinement. The discussions of the course demonstrated that “teaching teachers how to teach” (triple T) is a challenge and teaching design is not a “cookie cutter” process. The importance of introducing reality into the teaching studio was emphasized by most of the innovative
proposals and the joining of theory with practice was considered fundamental. Connecting theoretical content with the creative exploration of solutions to problems is important. Architecture courses must also build of a design repertoire that students may apply at each stage of a design discipline. This repertoire also needs reinforcing through specific criticism in the design studio setting. Finally, the importance of the architectural program was recognized in all to the proposals brought forward in the graduate course described here. In final analysis the course showed that a variety of activities should be present in the design studio, to break typical lethargies often found in traditional teaching environments.

The literature search and the proposals brought forward increased awareness on the many new and innovative ways of teaching design that are available today. These ways need to be tested and refined through experimentations in the real design studio setting. Their evaluation should apply the rigors of architectural research methods for the advancement science in architectural design education.

Acknowledgements

The authors of this paper would like to thank the students of the class of IC 09 “Metodologia de Projeto” of the second semester of 2005 given in the School of Civil engineering, Architecture and Urban Design for their contributions.

References


